

# Problem Set 5 - Solution - LV 141.246 QISS

## 1. Grover Algorithm

```
from QuantumGates import *
from pauli import *
from numpy import *

# preparing the elementary matrices
id = identity(2)
id3 = identity(8)
Had3=kron(kron(Had,Had),Had)

# oracle f(101)=1
Or=identity(16)
Or[10,10]=0
Or[11,11]=0
Or[10,11]=1
Or[11,10]=1

# Rotation about the mean
xi=ones((1,8))*2**(-3./2)
RM=2*dot(transpose(xi),xi)-id3

# Grover Gate
Grover=dot(kron(RM,id),Or)

# Grover Algorithm
psi0 = transpose(kron(array([1,0,0,0,0,0,0,0]),array([0,1])))
psi1 = dot(kron(Had3,id),dot(kron(id3,Had),psi0))
psi2 = dot(Grover,psi1)
psi3 = dot(Grover,psi2)

# Measurement
sz1 = dot(transpose(psi3),dot(kron(kron(kron(sigma_z,id),id),id),psi3))
sz2 = dot(transpose(psi3),dot(kron(kron(kron(id,sigma_z),id),id),psi3))
sz3 = dot(transpose(psi3),dot(kron(kron(kron(id,id),sigma_z),id),psi3))

print sz1, sz2, sz3
```